



# EU Directives and Their Impact on the Aerospace Industry

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# *A Summary of the Lead-Free Transition*



- European Union Directives (Reduction of Hazardous Substances-RoHS, and Waste Electrical and Electronic Equipment-WEEE) went into effect on 7/1/06
  - RoHS bans lead, mercury, cadmium, hexavalent chromium, PBB, PBDE
  - Lead (Pb) is of the most immediate concern to the aerospace industry
  - Aerospace industry is excluded or determined to be out of the scope of these directives
- However, platforms are being supplied “lead-free” items as the worldwide electronics industry converts to lead free processes and materials.

**The Lead-Free transition affects all platforms**

# ***Platform risks increase when Lead-Free is used in the build of material***

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- System Reliability and Warranty is impacted
  - Solders- Mixing of Pb Free and SnPb solders reduces solder joint lifetime reliability
  - Higher Temperatures - Board and component lifetimes are reduced due to higher temperature processing
  - Tin (Sn) Whiskers- Whiskers cause unintentional electrical paths leading to intermittent and permanent failures
  - Validated Lead-Free qualification Data and Models do not exist- Programs cannot rely on Mil-HBK-217 to assess system reliability alone

# ***Total Ownership Cost (TOC) increases***



- Part Obsolescence- Difficult and costly to maintain today's Lead (Pb) baseline as the majority of the suppliers convert to lead-free
- Configuration Management Issues-
  - Significant number of the vendors are not changing the part numbers for lead-free parts creating a logistical quagmire and future sustainment issues
  - There is no single drop in replacement for today's eutectic SnPb solder. Hence, multiple solutions are being touted as the lead-free solution
- Manufacturing Cost Increase - There is an increased cost of implementing new lead-free manufacturing, rework and repair processes
- Repair, Rework and Sustainment- There is an increased cost of maintaining dual inventories and manufacturing lines

# ***How your platform is affected***



- Reduced platform availability
  - Decreased, unknown reliability
- Increased repair and maintenance costs
  - Multiple inventories, tooling, training, and configuration management schema
  - Costly re-works
- Reduced platform service life
  - Incompatible replacement parts and processes
  - Higher temperature processing cycles

# ***AIA-AMC-GEIA Lead-free Electronics in Aerospace Project Working Group (LEAP WG)***



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- Formed in 2004
  - **AIA - Aerospace Industries Association**
  - **AMC - Avionics Maintenance Conference**
  - **GEIA - Government Electronics and Information Technology Association**
- Includes all stakeholders (market segments, supply chain, geographic regions)
  - **~90 meeting attendees**
  - **10 active task groups**
- Addresses issues that are:
  - **Unique to aerospace and military**
  - **Within control of aerospace and military**

# LEAP WG Actionable Deliverables



GEIA-STD-0005-1, Performance Standard for Aerospace and High Performance Electronic Systems Containing Lead-free Solder

**Used by aerospace electronic system “customers” to communicate requirements to aerospace electronic system “suppliers”**

GEIA-STD-0005-2, Standard for Mitigating the Effects of Tin Whiskers in Aerospace In High Performance Electronic Systems

GEIA-STD-0005-3, Performance Testing for Aerospace and High Performance Electronic Interconnects Containing Lead-Free Solder and Finishes

**Used by aerospace electronic system “suppliers” to develop reliability test methods and interpret results for input to analyses**

GEIA-HB-0005-1, Program Management / Systems Engineering Guidelines For Managing The Transition To Lead-Free Electronics

**Used by program managers to address all issues related to lead-free electronics, e.g., logistics, warranty, design, production, contracts, procurement, etc.**

GEIA-HB-0005-2, Technical Guidelines for Aerospace and High Performance Electronic Systems Containing Lead-Free Solder and Finishes

**Used by aerospace electronic system “suppliers” to select and use lead-free solder alloys, other materials, and processes. It may include specific solutions, lessons learned, test results and data, etc.**

GEIA-HB-0005-3, Rework and Repair Handbook for Aerospace and High Performance Electronic Systems Containing Heritage SnPb and Lead-Free Solder and Finishes

GEIA-HB-0005-4, Impact of Lead Free Solder on Aerospace Electronic System Reliability and Safety Analysis

**Used to determine, quantitatively if possible, impact of lead-free electronics on system safety and certification analysis**

(Published)

(in ballot)

GEIA-STD-0005-3

# ***Unfinished LEAP WG SOW***



- Document publication and maintenance
- Implementation – LFCP preparation and content
- Verification of compliance and acceptance
- Configuration Control
- Lead-free Time Line
- TOC Research



# Major Technical Issues



From a Position Paper prepared for the AIA Technical Operations Council (TOC):

## Specific aerospace risks:

- (1) unproven reliability of solder joints
- (2) degraded reliability due to “tin whiskers,”
- (3) loss of configuration control
- (4) impaired reparability

## Most urgent needs:

- (1) methods to analyze, test and qualify lead-free electronics for aerospace applications;
- (2) methods to assess and quantify effects of lead-free electronics in aerospace system safety and certification analyses;
- (3) better understanding of the causes and mitigation methods for tin whiskers; and
- (4) better understanding of the reliability of lead-free solder joints especially those associated with surface mount area array packages.

The aerospace industry must communicate its needs to the COTS electronics industry. Aerospace influence on this industry is limited due to our small market presence; however, we have gained significant technical knowledge that puts us in a position to define technical issues that must be addressed by the entire electronics industry, and to request solutions that will benefit both aerospace and the larger electronics industry. AIA is in a unique position to represent the aerospace industry in communicating this information to its electronics industry counterparts, such as the Semiconductor Industries Association.

# ***AIA TOC Research Support - Status***

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- Survey Sent to Identify on-going Publically available research
- Approximately 55 proposals received
- Almost all are for “push” projects
- Letter sent to OSD (AT&L)
- 12 % of the needed research is planned
- Need to work with AIA TOC and OSD to define next steps



***REACH***

# ***What is REACH?***



- A comprehensive European Chemicals Regulation.
- REACH = **R**egistration, **E**valuation and **A**uthorization of **C**hemicals.
- Will replace most of the current EU legislation and national laws on chemicals.
- Affects Manufacturers. Puts all responsibility of demonstrating the safety of chemical substances on the manufacturer or importer. (Reversing Burden of Proof).
- Strong focus on communication in the supply chain.
- Potential trade restriction.

# REACH Impact



- REACH will fundamentally change the way in which the (global) industry operates.
- This regulation will impact all functions in a company operating with or within the EU and will have effects on the complete supply chain.
- REACH will create opportunities for companies that are well prepared but will create serious risk for those that are unprepared.
- The regulation became effective June 1, 2007



***Questions?***